DOCUMENT RESUME

ED 191 266 FL 011 239

AUTHOR Greenfield, Patricia: Dent, Cathy
TITLE Syntax vs. Pragmatics. A Psychological Account of Coordinate Structures in Child Language. Papers and Reports on Child Language Development, No. 17.
INSTITUTION Stanford Univ., Calif. Dept. of Linguistics.
PUB DATE 79
NOTE 9p.

EDRS PRICE MF01/PC01 Plus Postage.
DESCRIPTORS *Child Language: Children: Cognitive Development: *Language Acquisition: Language Patterns: Language Research: *Phrase Structure: *Pragmatics: Psycholinguistics: Sentence Structure: Social Influences: Speech Communication: Speech Habits: *Syntax: Transformational Generative Grammar: *Verbal Development
IDENTIFIERS Conjunctions

ABSTRACT

This study considers the interaction of syntactic and pragmatic factors (social and cognitive) in children's production of coordinate structures involving conjunction reduction. Two aspects of pragmatic context were considered: (1) the pattern of uncertainty or redundancy in a complex action sequence, and (2) the perceptual grouping of objects used in the sequence. The analysis is based on data from 94 children, half of them aged 6 and half aged 10. The children described an action sequence that involved placing a series of three differently colored beads into a cup. Half the children described the action while it was going on: the other half, after it had been completed. In addition, half the children in each of these conditions described their own actions: the other half described the experimenter's actions. Analysis of the data indicates the pragmatic factors appear to control the syntax of coordinate sentences used to describe the complex action sequence in question. These results shed some light on a current controversy in child language on the presence and role of autonomous syntax in language acquisition. It is suggested that in the case of conjoined structures, syntax is in the surface structure only and that coordinate sentences are a direct linguistic representation of the perceived structure of the referential situation. (AMH)

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STANFORD UNIVERSITY
PAPERS AND REPORTS ON CHILD LANGUAGE DEVELOPMENT

pRCLD #17 (1979)

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SYNTAX VS. PRAGMATICS
A PSYCHOLOGICAL ACCOUNT OF COORDINATE STRUCTURES IN CHILD LANGUAGE

Patricia Greenfield
Cathy Dent
UCLA

A current controversy in child language relates to whether social and cognitive factors (sometimes lumped together as pragmatics) are sufficient to account for language acquisition without invoking an autonomous syntactic component. At the earliest stages there seems to be little evidence for autonomous syntax. But what about the later stages as syntax becomes more complex?[1]

The purpose of this report is to look at the interaction of syntactic and pragmatic factors in children's production of coordinate structures involving conjunction reduction. We considered two aspects of pragmatic context, each relating to the structure of the referential event: (1) the pattern of uncertainty or redundancy in a complex action sequence and (2) the perceptual grouping of objects used in the sequence. Each aspect of the pragmatic structure has its counterpart in a transformational syntactic account of conjunction reduction: (1) redundancy because redundant linguistic elements are eliminated; and (2) grouping because the remaining elements are grouped. According to Chomsky (1965), the transformational process of conjunction reduction takes conjoined sentences (e.g., I see the dog and I see the cat) and, through deletion and grouping, produces a single sentence with conjoined phrases in which repetitive or redundant elements have been eliminated and the remaining elements grouped (e.g., I see the dog and the cat.)

In transformational grammar, conjunction reduction is considered to be an autonomous syntactic process operating only on linguistic elements -- words. Yet redundant linguistic elements represent redundant elements in the real world. Our earlier research (Greenfield and Smith, 1976; Greenfield, 1978; Greenfield and Zukow, 1978; Greenfield and Dent, in press) has shown that constant or repetitive elements of a real world referential situation tend to go unspoken, while uncertain or changing elements are linguistically realized, yielding utterances that are informative in the general sense of semantic information theory: that is, they resolve uncertainty, select from among referential alternatives, mark points of change. Thus the perception of redundancy and change in a real world sequence of events could lead to the production of coordinate sentences, characterized by conjunction reduction. Perceptual grouping relates to the Gestalt properties of items in a stimulus array that are present in visual perception at the time of linguistic description. Such perceptual grouping could motivate the linguistic grouping that characterizes conjunction reduction. Referential redundancy and perceptual grouping constitute pragmatic motivations for the syntax of phrasal conjunction. These pragmatic factors were the focus of our analysis.

In our experiment we asked children, half age six and half age ten,

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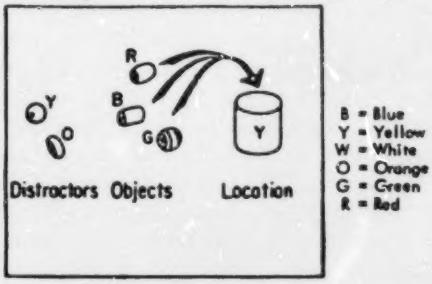
to communicate a complex action sequence involving certain redundant elements, so that a listener would be able to carry out the same action sequence. Half the children described the action while it was going on (simultaneous conditions), the other half after it had been completed (post conditions). In addition, half of the children in each of these conditions described their own actions (active conditions). The other half described the experimenter's actions (passive conditions). The analyses to be reported are based on data from 94 children. For present purposes, the relevant action sequence involved placing a series of three differently colored beads into a cup (see Figure 1). In a previous analysis (Greenfield and Dent, in press) we demonstrated that the probability of linguistic encoding increased with uncertainty of the elements,

Figure 1. **Beads in cup: Pot method with equivalent objects.**



where uncertainty is a function not only of the absence of redundancy or repetition, but also the presence of alternatives. Thus, one of the younger children described the action sequence this way:

(1) I put the red one in, the blue one in, and the green one in.

(In this example as in the ones below, commas indicate pauses of 1.0 sec. or longer without falling intonation; periods indicate falling intonation.) This description, for example, is typical in never mentioning the yellow cup, which, in the situation, is the only possible container, and therefore taken for granted in this role. Note too that the child and the action, constants throughout, are mentioned for the first act (I put), but not repetitively thereafter.

This analysis told us which elements are likely to be linguistically realized, which not. But it did not tell us anything about the syntactic organization of the lexical elements. What we are reporting here explores the question of syntactic organization.

A complex action sequence in which certain elements are repeated as the sequence proceeds should produce coordinate structures involving conjunction reduction. Such syntactic structures can be defined as sentences or phrases joined by a connective morpheme in which some linguistic redundancy has been reduced. (Because of the structure of the action sequence, and was the only connective morpheme generated by this task.) We did find many such structures in our descriptions and they became significantly more frequent with age (two-tailed chi-square test, $X^2 = 2.95$, $p<.05$). Here is an example from a ten-year-old child:

(2) She put blue red and green into the yellow one.
But, more important, given that the structure of an action sequence involving repetitive redundancy stimulates coordinate structures, how much can an understanding of the action sequence tell us about the precise nature of the coordinate structure?

In the syntactic description of phrasal conjunction, there are two types -- forward and backward (Ross, 1970). There has been some discussion in the literature recently as to whether forward deletion develops first. According to Bowerman (in press), the main protagonists are Lust and her colleagues (Lust, 1977; Lust and Mervis, 1978) and J. deVilliers and colleagues (deVilliers, Flusberg, and Hakuta, 1976, 1977). Whether or not forward deletion does develop first seems to depend on the nature of the particular language being investigated and the language task. Thus far, however, no one has looked at forward and backward deletion as a function of the pragmatic context. This is the goal of our analysis. And it may ultimately help to resolve some of the conflicting conclusions which have resulted from analyses of syntactic phenomena in isolation from their pragmatic context.

If the perception of redundancy motivates the reduction aspect of phrasal conjunction, then we would expect only one type, forward deletion. Forward deletion yields a coordinate structure in which all elements are linguistically realized in the first sentence, then repeated or constant elements omitted from the second sentence. This is illustrated in the following example:

(3) I see the dog and ~~I see~~ the cat.
(The cross-out line indicates what has been deleted from the full coordinate sentences.) The other type, backward deletion, yields a conjoined structure in which an element is omitted from the first sentence as in the following example:

(4) John ~~ate some cake~~ and Mary ate some cake.
Thus backward deletion is inconsistent with an explanation of conjunction reduction in terms of redundancy deletion because, in backward deletion, an element is omitted on its first potential appearance -- while it is still relatively uncertain or new -- then encoded in the second sentence when it should have become redundant or old.

In our experimental situation, there are four repetitive elements, agent, action, object and location. Example (1) above eliminates the repetitive agent and action (I put) through the production of a forward deleted structure in which I put appears in the first clause, but is omitted in later clauses. Forward deletion of agent and/or action was the most common form of conjunction reduction under all conditions.

However, the elimination of all four repetitive elements -- agent, action, object and location -- in a coordinate structure involves both forward and backward deletion, if one is to come out with a syntactically standard or preferred construction:

(5) I'm putting the blue ~~bead in the yellow~~, ~~I'm putting~~ the green

~~bead-in-the-yellow~~, and ~~I'm-putting~~ the red bead in the yellow. Whereas 'I'm putting' (agent and action) appears in the first sentence (forward deletion), 'bead in the yellow' (object and location) is omitted in the first (backward deletion). Thus the syntactically more standard form for eliminating redundancy in the locative phrase (backward deletion) is at odds with the syntactic form generated by applying the pragmatic rule to eliminate objects and locations as they are repeated (forward deletion).

But backward deletion can also be pragmatically motivated -- by the grouping factor. Backward deletion of the prepositional phrase yields a description that linguistically groups the three beads together just as they are physically grouped in the yellow cup at the end of the action sequence. Here is a hypothetical example of this sort of backward deleted structure:

(6) You put the red, the green, and the blue into the yellow.

Note that grouping causes mention of location to be deferred to the end of the sentence, the position which would also result from a backward deletion process.

For those children who are describing action in progress, (simultaneous conditions), repetitive action should be a salient factor in their verbalizations. If the pragmatically motivated tendency to omit repeated action elements is dominant, then we should not find any structures which could have been created by backward deletion. Indeed, the elimination of mention of a repeated location should lead to less standard syntactic forms, i.e., syntactic structures which could have been created by forward deletion, where the preferred form is a backward deleted one. Here is a hypothetical example:

(7) Put the red in the yellow, the blue, and the green.

On the other hand, for those children who are describing completed action (post conditions) the action component should be less salient, the current state of affairs -- three beads in a cup -- relatively more salient. For these children, the grouping of the beads will be a perceptual factor favoring structures which could have arisen from backward deletion as in Example (2) above.

Our results are exactly in line with these hypotnesized pragmatic processes. Virtually no structures which could reflect backward deletion occur in the simultaneous conditions. Of those children who conjoin object properties (usually colors) or objects (beads), thirty-three out of thirty-five (94%) use the less standard forward deleted form rather than the more standard backward deleted form. (94% is reliably different from a chance rate of 50%; $p < .001$, according to a one-tailed binomial test.) Because Lust's (1977) findings indicate that backward deleted forms are within even the younger children's competence, the less standard forward forms appear to stem from combining the linguistic realization of new action elements with the omission of repetitive ones. Here is an example from a ten-year-old girl who described the action sequence while watching the experimenter carry it out:

(8) She putting a red bead in the yellow, and a green one, a blue one.
The important fact about this example is that the object and locative phrase bead in the yellow is realized the first time a bead is put in the yellow cup, then subsequently omitted. The syntactically preferred form, in contrast, would omit bead in the yellow when the first bead was placed in the cup and then realize it upon the last repetition of this action element, yielding a sentence like this:

(9)She putting a red, a green, and a blue bead in the yellow.

When, however, the action sequence is described after the fact (post conditions), we do find that a number of children using conjunction reduction form structures which could have arisen from backward deletion. Here is an example from a ten-year-old who has just watched the experimenter carry out the action sequence:

(10) She put blue red and green into the yellow one.
Note that linguistic grouping of the bead descriptions reflects their physical grouping in the yellow cup at the time of description.

While forward deleted forms for omitting redundant mention of object (bead) or location (yellow cup) still predominate in the post conditions (62%), backward deleted forms become much more prevalent than under the conditions of simultaneous description (38% in the post conditions vs. 6% in the simultaneous conditions). A Fisher Exact Probability Test indicates that the difference between the number of children manifesting backward deletion of object and/or locative phrase in the post vs. simultaneous conditions is statistically significant ($p = .02$, two-tailed test).[2]

In our particular experiment, there is another pragmatic factor that could augment the use of backward deletion: the opportunity to plan one's utterance (cf. Keenan and Bennett, 1977). That is, omission of the earlier of two identical elements must involve planning ahead to the end of the sentence, a factor J. deVilliers, Flusberg, and Hakuta (1977) have identified as important. Consider this example:

(11) John ate some cake and Mary ate some cake.
In order to omit 'ate some cake' after 'John', the speaker need realize at that point that Mary did too. In order to plan the end of an utterance while or before producing the beginning, the referential situation must not be in flux and must alread be known. This would be the case when the description was produced after the action was complete. Thus, grouping cues are confounded with planning cues in the comparison of post and simultaneous conditions. In order to separate out planning cues from grouping cues, an analysis was done holding grouping cues constant. Because a demonstration was given in advance in the conditions where the child carried out the action sequence herself (active conditions), but not where she watched the experimenter (passive conditions), the active conditions provided more planning cues than the passive conditions. Grouping cues were, however, equal in the two types of conditions. Comparison of the two active conditions with the two passive conditions for proportion of forward and backward deletions of object and/or prepositional phrase revealed no significant differences between the two conditions. Hence planning cues do not seem to augment backward deleted structures in the

way that grouping cues do.

In conclusion, pragmatic factors appear to control the syntax of coordinate sentences used to describe the complex action sequence examined in the present study. The overriding result, dominant in all conditions, is that repetition of elements in an action sequence stimulates forward deleted structures. In this type of coordinate sentence, an action element (e.g., location) is linguistically realized the first time it appears, but drops out on subsequent repetitions. This cognitive strategy for utilizing information about the action sequence being described leads to a more or less standard syntactic form of forward deletion, depending on whether repetition occurs in agent-action or object-location. This is because forward deletion of subject and/or verb leads to a standard syntactic form (as in Example (1)), whereas forward deletion of object and/or locative adverb or phrase leads to a less standard form (as in Example (8)). The prevalence of these forward forms where backward would be preferred or more standard is all the more interesting when one considers that backward deleted forms are within children's competence even before age six, the youngest age level in this study (Lust, 1977). Thus, how standard the syntax of coordination will be is influenced more by the pattern of redundancy in the referential situation than by level of competence with some generalized syntactic process of backward deletion. Within our own study, this point is illustrated even more dramatically, for, when visual grouping cues are stronger, backward deleted structures are produced by children the same age as those who produce only forward deleted structures when grouping cues are weaker.

Far from demonstrating the presence of autonomous syntax, our results seem to show its control by pragmatic factors relating to the perceptual structuring of the referential situation. One is led to wonder about the role of these pragmatic factors in the original acquisition of the syntax of coordination (cf. Ervin-Tripp, 1977). Indeed, the effect of pragmatic factors on the syntax of coordination was so strong in our study that we are tempted to propose the following: the transformational process of conjunction reduction does not have psychological reality.[3] That is, the child does not generate full sentences from which elements are subsequently deleted. Instead, the perception of a referential situation provides the base structure from which the coordinate structure is generated. Linguistic elements do not come into being at all if they can be assumed from the structure of the referential situation; thus, linguistic elements are omitted, not deleted. The term deletion has no meaning without a syntactic base structure and should be abandoned. Similarly, grouping of linguistic elements (words) is not so much the result of a transform tion as of a perception based on the gestalt qualities of the words' real-world referents.

These results lead us to doubt the psychological reality of a purely syntactic explanation of conjoined structures, in terms of the transformation of a syntactic base structure. Instead, we would like to keep syntax in the surface structure only, and propose (somewhat radically if

tentatively) that coordinate sentences are a direct linguistic representation of the perceived structure of the referential situation.

Footnotes

1. Osgood demonstrated the role of the pragmatic context in structuring grammar as early as 1971. Osgood and Bock (1977) is an example of more recent psychological work in this area. On the linguistic side, Hankamer and Sag (1976) have made a distinction between syntactic and pragmatic factors in anaphoric processes.

2. One child who showed both backward and forward deletion of a locative was eliminated from the sample for this statistical test.

3. J. deVilliers, Flusberg, and Hakuta (1976) also reject a transformational account of the ontogenesis of coordination by a different line of argument, one which, however, may turn out to be related to that being presented here.

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